

Diarrheal Disease and Health Services in Latin America

ALFRED YANKAUER, M.D., and N. K. ORDWAY, M.D.

NINETY PERCENT of deaths from diarrhea in the middle and southern sections of the Americas are in children under 5 years of age. It is estimated that this disease has been the cause of death of almost a fourth of the million young children who die annually in this part of the world. If the diarrheal disease death rates of North America were to prevail throughout the Western Hemisphere, the number of deaths would exceed by 98 percent the number expected.

Diarrhea is conceived of as a disturbance of intestinal motility and absorption, which once and by whatever means initiated may become self-perpetuating as a disease through the production of dehydration and profound cellular disturbances, which in turn favor the continuing passage of liquid stools (1).

The age-specific mortality from diarrhea is highest during the first year of life. The heavy concentration of deaths that occur during the first few months after birth was pointed out some years ago by Verhoestraete and Puffer (2). It is emphasized by more recent data from Venezuela and Colombia (tables 1 and 2). In Venezuela almost half of the

deaths in children under 5 years of age occurred during the first 6 months of life while in Colombia the proportion is almost one-third.

The incidence of diarrhea appears to vary with infant feeding practices related to supplementation of or substitution for breast milk. Some Latin countries show reduced morbidity as early as the sixth month and others as late as the third year of life.

Diarrhea in young children is frequently associated with other infections and with protein-calorie malnutrition. The epidemiologic relationship between diarrheal disease and malnutrition has been extensively documented in recent studies carried out by The Institution of Nutrition in Central America and Panama (3). A recent study by Heredia and associates (4) suggests that the effect of educational efforts in reducing subsequent diarrhea may be more productive when directed toward families of children with diarrhea complicating malnutrition than when directed toward the families of all children with diarrheal disease.

Specific Etiology and Chemotherapy

Most cases of diarrhea are considered to originate as enteric infections, and in parts of the world where this malady is frequent and causes many deaths, a recognized causative agent can frequently be isolated.

Species of *Shigella* and *Salmonella* have long been recognized as causatives of diarrheal disease. In the past decade enteropathogenic strains of *Escherichia coli* have become incriminated with frequency in the production of nosocomial epidemics in young infants and frequently may be recovered in endemic diarrhea,

Dr. Yankauer is regional adviser in maternal and child health to the Pan American Sanitary Bureau, Washington, D.C. Dr. Ordway, professor of pediatrics, Yale University School of Medicine, New Haven, Conn., is now in Cali, Colombia, as visiting professor of pediatrics at the University of Valle Medical School, on sabbatical from Yale. This paper was adapted from a working document prepared for the technical discussions of the 14th Pan American Health Organization meeting of the directing council, Washington, D.C., September 1963.

particularly in children under 1 year of age. *Entamoeba histolytica* has been recovered with frequency in cases of diarrhea with bloody stools even in children under 2 years of age (5, 6).

Prevalence of the disease appears to be considerably greater in certain areas (5, 7-13). Of particular interest has been the recent immigration of large numbers of country dwellers into city slum areas in Venezuela. This population move has been associated with a considerable upsurge in cases of diarrhea.

The relative importance of viruses in endemic diarrhea is at the moment disputable. Whatever their role, no antiviral chemotherapy is available.

Clinically, there is little to distinguish among diarrheal infections due to viruses or bacteria. Perhaps 15 percent of all cases of diarrheal diseases are associated with the passage of bloody stools, although this percentage may rise to nearly 50 percent in *Shigella* infections (14).

Only *Shigella* and enteropathogenic *E. coli* have been shown to be effectively eliminated from the body with chemotherapy. The use of appropriate antibiotics has been important in the therapy of newborn infants with *E. coli* infections, but the same antibacterial effectiveness of a variety of drugs against *Shigella* has not been attended with comparable clinical improvement of the patient.

From a statistical standpoint, it is known that the duration of diarrhea may be somewhat shortened if *Shigella* can be eliminated, but most

Table 1. Distribution of deaths from diarrhea under 5 years of age, by age at death, Venezuela, 1961¹

Age at death	Number of deaths	Percent	Average percent per month
Under 28 days.....	328	7.4	7.4
28 days-2 months....	385	15.5	7.7
3-5 months.....	1,063	24.1	8.0
6-8 months.....	802	18.2	6.1
9-11 months.....	537	12.2	4.1
12-23 months.....	669	15.2	1.3
24-35 months.....	171	3.9	.3
36-47 months.....	99	2.2	.2
48-59 months.....	57	1.3	.1
Total.....	4,411	100.0	-----

¹ Deaths certified by a physician as due to diarrhea (gastroenteritis and diarrhea of the newborn).

Table 2. Distribution of deaths from diarrhea under 5 years of age, by age at death, Colombia, 1960¹

Age at death	Number of deaths	Percent	Average percent per month
Under 28 days.....	1,187	6.0	6.0
1-5 months.....	4,932	24.8	5.0
6-11 months.....	5,303	26.7	4.4
12-23 months.....	4,840	24.3	2.0
24-59 months.....	3,634	18.2	.5
Total.....	19,896	100.0	-----

¹ Includes deaths from diarrhea of newborn in 1961 and from dysentery and gastroenteritis, 1960.

recent studies continue to show the ineffectiveness of antibiotics in altering the clinical picture of diarrheal disease (4, 7, 10, 11). For example, in a double blind study in Caracas (15), the effect of chloramphenicol was indistinguishable from that of a placebo.

It is reasonable to conclude that the identification of an infectious agent and the chemotherapy of a case of diarrheal disease are of limited usefulness except for infections due to enteropathogenic *E. coli* in nursery epidemics or *E. histolytica*. Antibacterial agents are expensive as well as ineffective on the whole. Among the potentially harmful results of their use is the production of diarrhea or the possible invitation to enteric infection by resistant organisms such as *Staphylococcus aureus*. Mycotic infections and bone marrow depression have been reported. The potential hazards associated with the routine use of chemotherapeutic agents very likely outweigh their possible benefits.

Despite lack of documented effectiveness, antibacterial therapy enjoys widespread acceptance.

Suppression of Diarrhea

Except for withholding food, the short-term usefulness of which will be commented on when oral fluid therapy is discussed, measures designed to suppress the passage of loose stools are notably unsuccessful. Paregoric can be used to the point of depressing the central nervous system without affecting the frequency or

character of the stools. Use has not proved the practical or theoretical effectiveness of proprietary preparations designed to: (a) absorb hypothetical toxins, (b) soothe the inflamed intestinal mucosa, (c) alter intestinal function by changing bacterial flora, or (d) disguise liquid stools by the hygroscopic action of inert solids. Reduction in fecal loss of water and electrolytes has not been demonstrated with these preparations nor has it been shown that they selectively remove only noxious substance from the gut.

Dehydration

Except for certain rare complications, death from diarrhea is due to dehydration or its serious consequence, shock. Treatment of diarrheal disease thus resolves itself into averting or repairing dehydration through appropriate fluid therapy.

When dehydration occurs, fluid therapy becomes more complex in that deficits must be repaired—much different from simply giving fluids and electrolytes to replace those being lost from the body by normal and abnormal routes.

The goals of rehydration are threefold and indissoluble: prevention or treatment of shock, restoration of effective renal function, and replenishment of deficient water and electrolytes. These are assured through restoration and maintenance of an adequate circulating volume of blood.

Rehydration progresses in two phases: (a) a rapid phase of repairing deficits of sodium chloride and water and (b) a more gradual phase of restoring deficient potassium, adjusting residual deficits and osmotic and acid-base disturbances, and return to normal alimentation. The requisite fluids for these two phases are different as are their rates of administration.

Prevention of Dehydration

Pediatricians feel that severe dehydration due to diarrhea may be averted if oral administration of fluids is commenced early in the illness. Fluids have been given orally to as many as half or even more of the children coming to rehydration centers in Latin America. Success is usually assured if the child is not vomiting.

The prevention of dehydration, as opposed to the prevention of diarrhea itself, is a basic feature in all programs for the control of diarrheal disease. The important features of this therapy are:

1. Providing liquids by mouth which, at least theoretically, approximate in content and volume the aggregate of those fluids lost abnormally in the diarrheal stools and normally via lungs, skin, and kidneys.

2. Suspending all food intake for a brief period. Twelve hours of calorie starvation usually suffice and may be more than adequate. Rarely should 24 hours be exceeded. The child's usual food does not cause diarrhea but may briefly aggravate it. Prolonged restriction of food can only enhance the malnutrition that is frequently present without fundamentally benefiting the diarrheal process.

Vomiting associated with diarrheal disease is infrequent in the course of the illness but makes its appearance in most children as dehydration becomes more severe. Early oral fluid therapy averts not only dehydration but also vomiting which makes oral administration of fluids difficult or impossible. Vomiting frequently can be controlled by giving teaspoonfuls of the hydrating solution at intervals of 5 minutes or more. In unrelenting vomiting, drugs including tranquilizing agents in small dosage, have been used with success.

Solutions for oral therapy in general use in Latin America vary in composition from boiled water and sweetened tea, which have essentially no electrolyte content, through one-third to one-half isotonic solutions, to Ringer's solution, which is isotonic. (Isotonicity refers to the normal osmotic concentration of body fluids, approximately 300 mOsm/l.) Examples of such solutions are listed in table 3. Most are dispensed as solid concentrates to be dissolved in boiled water and given by the mother. In general, they have been accepted with eagerness by infants and children. When reluctance has been encountered in Mexico, the addition of cinnamon, manzanilla, or yerba buena to the solution has made it acceptable. The sucrose contained in several of the solutions provides a useful source of calories during the period of suspension of other feeding; it also makes the electrolyte solution more palatable.

The various solutions listed in table 3 have been given to many patients with considerable success. Little is known, however, of their effect on the electrolyte economy of the body when treatment is unsuccessful. As long as renal bloodflow is adequate, the kidney is able to make extensive adjustments in the interest of homeostasis of body fluids.

A word of caution is in order about the use of Ringer's or lactated Ringer's solutions, which are recommended in some parts of Latin America and are dispensed either as the solution itself or as powders in packets obtainable without prescription and designed for solution in a liter of water. Ringer's solution contains 147 mEq/l. of sodium and has an osmotic concentration of 309 mOsm/l. Lactated Ringer's solution contains 130 mEq/l. of sodium and has an osmotic concentration of 272 mOsm/l. The potassium content of each solution is negligible at 4 mEq/l. Neither is suitable for the replacement of diarrheal losses.

Oral fluid therapy is recommended unequivocally as the regimen of choice in early mild cases of diarrhea. It is practiced widely and promptly through all facets of the health service in some countries in Latin America, notably in Venezuela, but it is not relied upon everywhere to the extent that its promise dictates.

Fluid Therapy of Dehydration

Fluids can be given orally with success to many dehydrated children, especially if the child is not vomiting. De la Torre and Larracilla Alegre (8) were successful in 90 percent of the dehydrated children they attempted to treat. This experience, however, was unusually carefully supervised, and no net saving in time of medical and paramedical personnel appears to have resulted.

Gastroclysis appears today to be enjoying less extensive use owing in large part to the increasing skill of doctors and nurses in intra-

Table 3. Useful electrolyte and sugar concentrates available in Latin America to prevent diarrheal dehydration

Type and availability of product	Composition	Directions for solution	Concentration when dissolved as directed		
			Na (mEq/l.)	K (mEq/l.)	Total electrolytes (mOsm/l.)
Table salt, cane sugar, available in homes.	Table salt, ½ tsp., cane sugar, up to 3 tbsp.	Dissolve in 1 liter of water.	40	0	80
Pill, distributed by Ministerio de Sanidad y Asistencia Social, Venezuela.	Sodium chloride, 1.5 gm., potassium chloride, 0.5 gm.	Dissolve 2 pills in 1 liter of water; add 2 tsp. panela or raspadura de panelón.	52	13	130
Packet (sobrecito), distributed by Secretaría de Salubridad y Asistencia Mexico.	Sodium chloride, 3.0 gm., potassium chloride 1.0 gm., sucrose, 46 gm.	Dissolve contents of packet in 1 liter of water.	52	13	130
Proprietary pill (Hydrax, Johnson & Johnson), available in Brazilian health centers and pharmacies.	Sodium chloride, 0.214 gm., potassium chloride, 0.142 gm., sodium citrate, 0.262 gm., excipient, 0.63 gm.	Dispensary use: dissolve 1 pill in 150 ml. of water or 5 percent glucose solution. Home use: dissolve 3 pills in 2 glassfuls of water.	42	12	108
Original formula of department of pediatrics, Louisiana State University School of Medicine. ¹	Sodium chloride, 1.5 gm., potassium chloride, 2.0 gm., sucrose, 50 gm. ²	Dissolve in 1 liter of water.	26	27	106

¹ Reference 18.

² A liquid concentrate is also described, prepared by dissolving salts in 15 ml. of water, then adding 60 ml. of syrup of raspberry instead of the sucrose. Reference 18.

venous techniques. In two Venezuelan States, dehydrated children are being treated exclusively with gastroclysis so that this route may be compared with the intravenous therapy used elsewhere in that country. Although personal communication from Dr. Pastor Oropeza notes that results are not yet available, a value judgment seems to have been made in that a particularly ill child, instead of being treated by gastroclysis in a rural hydration center, is usually referred to a hospital for intravenous therapy.

Subcutaneous fluids have been used successfully in the treatment of dehydration in South Africa but with poor success in Poland (1). There is no knowledge of their routine use in Latin America.

With severe dehydration, intravenous therapy and hospital care are mandatory. In Latin America intravenous fluid therapy is widely practiced, with rare resort to cut-down and even rarer use of bone marrow infusion. By and large, puncture of superficial veins is a skill developed to a high degree in medical centers, especially among nurses and not infrequently among auxiliary personnel as well. In certain parts of Brazil extensive use is made of subclavicular vein puncture as first described by Aubaniac (16).

The complex problems of intravenous fluid therapy require more extensive consideration than is possible here. We have surveyed and commented on this subject in Latin America in another publication (17).

Hospital Treatment

Although mortality from diarrhea is decreasing in many areas of Latin America because severe dehydration has been prevented through better nutrition, health education, early recognition of disease, and fluid therapy of afflicted children, the number of deaths of dehydrated children admitted to hospital and rehydration centers remains high.

Treatment of acutely ill persons in many hospitals and health centers is often fragmented by passage of responsibility for patient care through a succession of physicians who serve for only a few hours each. In some hospitals no physician is in attendance during much of

a 24-hour day, particularly at night, when nursing coverage also may be scanty. Some existing residency programs make no provision for nighttime medical supervision except on an emergency basis, so that care for the critically ill patient again may pass through a succession of physicians who have no continuing awareness of the patient's changing needs. These shortcomings come sharply into focus in considering the care of dehydrated, undernourished children, half of whom die during their first day or two in the hospital.

The interruption of close medical supervision and suspension of supervised fluid therapy of dehydrated children, making necessary their transfer home for further care while still critically ill, cannot help but result in fatalities that the presence of a qualified attendant might prevent.

Organized Health Care

We are familiar with organized health care programs for the control of diarrheal disease in Venezuela, Chile, and Mexico. They represent efforts deliberately planned at a national level and executed locally over large areas of these countries.

Venezuela. Venezuela for 27 years has had an integrated program at the national level, carried out by the division of maternal and child health of the Ministerio de Sanidad y Asistencia Social. Health centers and rural medical centers have been established throughout the Republic. Since 1941 particular emphasis has been placed on diarrheal disease, and since the end of 1958 rehydration centers have been created in rapidly increasing numbers as part of the national campaign against gastroenteritis. All physicians assigned to a unit of the health care services dealing with children attend refresher-orientation courses including practical experience in applying rehydration techniques. Efforts by nurses and auxiliaries are aimed at early casefinding and oral administration of an electrolyte solution prepared from pills distributed throughout the country.

Children may be treated on an ambulatory basis or detained at the center for intravenous therapy if home treatment seems to be inadequate. Therapy at the center may last from

a few hours to a few days. Health centers are open for emergency care, such as rehydration of a child with diarrhea, 24 hours a day. If the infant is detained at the center for intravenous fluid therapy, the mother stays with him to learn more about the prevention and management of diarrhea. The integrated unit provides a structure for continuity of care and followup of any associated nutritional disease.

The effectiveness of Venezuela's integrated program may be seen in Caracas, where rehydration centers have been established not only in the central hospitals but in sectors of the city. Despite an influx of country dwellers into the congested slum areas of Caracas, deaths due to diarrheal disease have decreased, especially in recent years as the specific attack against dehydration has been intensified.

Chile. Chile's organized national program against diarrheal disease has functioned within the structure of a comprehensive health care service. Of particular interest is the operation of services within the city and suburbs of Santiago. This zone is divided into five major areas, each responsible for 500,000 or more persons. Responsible for the health of children and central to each area is a children's hospital or division in a general hospital with personnel who supervise and deliver the health care in outlying clinics. After-hours emergency medical care is available in a centrally located office from which major problems may be referred to the hospital if necessary. Exchange of information between hospitals and clinics is prompt. Followup after hospital discharge is through the nearest clinic.

In the Area Sur of Santiago, the age-specific mortality due to diarrhea in children under 2 years of age fell from 1,010 per 100,000 in the summer of 1960 to 490 in the summer of 1963.

Mexico. The Mexican campaign against diarrhea is of special interest because it represents a direct approach to the community. The people were mobilized to help solve their own problems, and educational and early treatment efforts were combined. The most successful efforts to date have been in the areas without ready access to health care services.

The technique of organization is simple. After consultation with the coordinator of medical services, local physicians and nurses, and community leaders in the central village of each

municipality to be organized, an open meeting is held with citizens of the community. Community members are designated as responsible for certain parts of the town or village population. After further indoctrination and the distribution of packets of electrolyte powder, the "block leaders" carry on educational work in their sector on a family-to-family basis, focusing on the importance of prompt treatment, especially in the young children. Major efforts are timed to coincide with the peak of the diarrheal season, which is rather sharply limited to 4 or 5 months (May through August).

Cooperation of rural communities in this campaign has been impressive. Preliminary data suggest an estimated 50 percent reduction in deaths from diarrheal disease in communities with organized programs. There is indication that severe diarrheal dehydration is being reduced while no effect on morbidity of diarrhea has been observed.

Conclusions and Summary

Mortality ascribed to diarrheal disease is the most striking pathological characteristic of the middle and southern sections of the Americas. It has been estimated that diarrhea is the cause of death in almost a quarter of the million young children who die annually in this part of the world.

Because of shortages in personnel and supplies, it is impossible to reach a significant proportion of this population with methods of primary prevention that can be expected to reduce the incidence of diarrheal disease significantly.

On the other hand, personal health care services, when considered as a comprehensive whole, have unique and important contributions to make toward the reduction of preventable deaths from diarrheal disease.

Neither antibacterial therapy nor drugs to suppress diarrhea as a sign are routinely helpful. Treatment resolves itself into averting or repairing dehydration through appropriate fluid therapy.

Preventing dehydration by early oral fluid therapy, as opposed to the prevention of diarrhea itself, is a basic feature of all programs for the control of the disease. Various types of solutions are used as are other forms of fluid therapy and hospital care programs.

Successful diarrheal disease control programs in Venezuela, Chile, and Mexico have relied heavily on early oral rehydration and effective parental therapy promoted in an organized way through existing health care services.

The key to the success of health care programs in reducing the mortality from diarrheal disease in Latin America lies most importantly in measures to reduce dehydration through early casefinding and appropriate oral fluid therapy. Backing this crucial phase of the program are emergency hydration centers and hospital outpatient departments or health units. There is a great need for convalescent resources in day-care centers and institutions for the severely malnourished child who has been saved from death due to dehydration.

Education of the community must be accompanied by attention to the effectiveness and availability of treatment and followup care. A close personal relationship between the physician-medical team and the patient and family are required.

Studies are needed to simplify and perfect the techniques that can be most efficiently applied by the health care services to save more lives.

A program of health care that provides early and adequate treatment of diarrheal diseases in young children can significantly reduce mortality in early childhood.

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Program Notes

Institute on Disease in Elderly

The Jewish Home and Hospital for Aged, Bronx, N.Y., held an Institute on the Prevention of Diseases and Disability in the Elderly, on September 24, 1964 for persons professionally engaged in services to the aged. Speakers emphasized the necessity for intensive study and for treatment earlier in life. They also dwelt upon such urgent topics as accident prevention, mental hygiene, and measures for control of malignant disease.

Alert for Encephalitis

Flocks of chickens serve as sentinels against any sneak attack by encephalitis in New Mexico. The vector control section of the State health department sets mosquito traps within special chicken pens to permit collection of live mosquitoes for weekly identification and virus isolations. Chickens are bled monthly for antibody determination. Thus an early alert may be expected if the encephalitis virus becomes active; knowledge of the species carrying the virus, in case it appears, will also be obtained.

Casefinding by Cytology

Forty-six positive cytology specimens were uncovered in 1963 among 9,275 women examined in the general hospital cytology program of the New York State Department of Health. Additional funds have been allotted to support hospitals carrying out this program in 1964.

Ten of the definite cancers were diagnosed as carcinoma in situ, indicating that at least one-third of the cases detected had been unsuspected by patient and physician.

The Pennsylvania Department of Health, aided by a \$120,000 Public Health Service grant for a 3-year program, plans demonstrations in all health regions of the State to show

dentists and physicians how to uncover mouth cancers in the early stage. The tools will be a glass slide and a wood scraper.

Cancer of the oral cavity and pharynx was responsible for 419 deaths in 1963 in Pennsylvania.

Seat Belts for School Bus Drivers

Orchard View Community Schools in Muskegon Township, Mich., have installed seat belts for drivers on each of the district's 17 school buses.

N.J. Aid for Migrants

The New Jersey State Department of Health, with funds available from the Public Health Service, has contracted to pay the National Travelers Aid Association \$11,000 for the period May 1, 1964, to May 1, 1965, to add services designed to protect the health of migrant agricultural workers in New Jersey and after they leave the State.

The association has agreed to provide a caseworker and a mobile unit for visiting labor camps, hospitals, and other locations; to assure continuity of planning for the migrant workers throughout the country, through use of the association's offices; and to encourage effective relationships among all groups serving the migrant and his family.

Cancer in the Young

Cancer, for some time the leading fatal disease in the age group 1-14 years, is now responsible for more than one-fifth of all deaths from disease in that age group.

Health Aid to Military Rejects

The Maryland State Department of Health has established a counseling and referral service to help the large number of draft-age youths who are rejected for military service because of physical reasons. Purpose of the program is to promote early diagnosis of health problems

and encourage the youths to seek medical care promptly, thus alleviating medical, vocational, and social difficulties.

Project for Mentally Retarded

In a project of the Hawaii Department of Health's mental retardation division, former residents of an institution for the mentally retarded meet once a week for 1½ hours with Dr. Setsu Furuno, the chief psychologist. They learn about community facilities, ventilate feelings of isolation and loneliness, and discuss their problems and satisfactions in relations with their employers and families.

Dr. Furuno has arranged for a special YWCA class in sewing for the women discharges in the hope that "they will seek out other recreational and skill programs on their own."

TB Casefinding

In southeastern Michigan, 275 active cases of tuberculosis were discovered in tuberculin tests of 800,000 school children from September 1957 to December 1962. About 1.7 percent of the children were reactors. In 33,745 contacts of the reactors, an additional 116 new cases were found through X-ray.

Mobile Chest Screening Unit

A Christmas Seal mobile health unit, put into service in October 1963, enabled the Buffalo and Erie County (N.Y.) Tuberculosis and Health Association to screen additional thousands for chest disease. In 5 months, 10,500 X-rays and 2,000 breathing tests were provided; brief medical histories were also taken. Special groups served included medical and dental students.

Buffalo's "Health-O-Rama"

At a "Health-O-Rama" held in Buffalo, N.Y., in 1963, more than 21,000 persons registered and 20,000 took tests. Twenty-three community health agencies participated in a 4-day program of free health screening tests, exhibits, and demonstrations. Persons tested were informed by mail of results and told to inform their physician if results were positive.